



The Natural Resource Challenge

The popularity of National Parks has continued to grow since the U.S. Congress established Yellowstone, the first national park, in 1872. The 385 parks in the National Park System draw millions every year who come to experience the outdoors in spectacular settings or to learn about historic events where they happened. In the great scenic parks such as North Cascades people can recover from the stress of face-paced lives and reconnect with nature through camping, hiking, climbing, studying natural history and other activities.

From the moment of Yellowstone's establishment, there have also been people who saw national parks as important for science. As world population and related development increases, the scientific value of protected areas such as North Cascades National Park becomes increasingly evident. This fact combined with the great gaps in the National Park Service's knowledge of just what natural resources are in the parks has led in recent years to a significant change of direction for the agency. Without much more complete knowledge of the plants and animals in the national parks, the geology of these special places, and the ecological processes tying all these natural elements together, park managers cannot be certain that they are adequately protecting the parks.



Park Geophysicist Jon Riedel studies North Cascades glaciers. (See page 3)



Park Biologist Roger Christopherson assists with glacial research.

The National Park Service calls the new direction toward obtaining this knowledge the "Natural Resource Challenge". It extends to learning more about the cultural resources, such as archeological sites and historic structures, preserved in the national parks.

In support of the Natural Resource Challenge, the U.S. Congress is providing funding to help the Park Service:

- ◆ Inventory natural resources and learn how to monitor their trends
- ◆ Restore natural systems degraded by the introduction of non-native plants and animals
- ◆ Encourage scientific research in national parks
- ◆ Obtain scientific information needed to better manage the parks
- ◆ Share the knowledge gained with the public.

This newspaper describes some of what is happening and what is being learned in North Cascades National Park because of the Natural Resource Challenge.

North Cascades is part of the North Coast and Cascades Network of national parks and historic sites working together to implement the challenge: North Cascades, Olympic, and Mount Rainier National Parks, Ebey's Landing National Historical Reserve, San Juan Island National Historic Park, Fort Clatsop National Memorial, and Fort Vancouver National Historic Site.

Learn more about North Cascades resource management at <http://www.nps.gov/noca/nat.htm>.



Rugged Mount Shuksan stands tall and white with snow beyond Picture Lake. Photo: Robert Morgan

The North Cascades: a unique and treasured ecosystem

The rugged landscape of North Cascades National Park is home to a unique collection of plants, animals, natural processes, and cultural resources.

Here over 300 glaciers carve peaks that tower above deep valleys dark with ancient forests. Old growth cedar, pine, and fir contrast with subalpine meadows full of colorful flowers. Animals as common as ravens and as rare as grizzly bears are at home in the many different habitats of the range.

These treasures and more lie within the North Cascades ecosystem. Assuring its health is the central goal of the North Cascades National Park Service Complex, comprised of North Cascades National Park and the adjacent Ross Lake and Lake Chelan National Recreation Areas. The park complex is located in the heart of the North Cascades ecosystem that extends from Snoqualmie Pass in Washington to the Fraser River in British Columbia.

Straddling the crest of the Cascade Mountains, the park encompasses a great variety of life zones. Elevations soar from 400 feet to more than 9,000 feet above sea level. Dramatic rainfall differences from 25 inches on the east side of the range to well over 100 inches in some areas on the west result in diverse vegetation and wildlife. The presence of more than 1,600 vascular plant species and an estimated 3,000 or more kinds of fungi gives some idea of the diversity of life in this place.

To know if the park is being adequately protected, the National Park Service must assess its ecological health. Park scientists are learning to do this by monitoring "vital signs." Ecosystem vital signs range from the growth versus shrinkage of glaciers to the presence or absence of certain aquatic insect larvae in the park's watersheds and trends in the populations of particular birds and mammals.

The presence and quantity of airborne pollutants in glaciers and the lakes they feed can provide a measure of the impact of distant human activities. These indicators and more will allow scientists to determine the overall health of the park's ecosystem and which way it is headed.

Be a steward!

Help preserve our Natural Heritage:

- ◆ Tread lightly on the land and leave no trace.
- ◆ Respect the wilderness, wildlife and fellow visitors.
- ◆ Be aware of and avoid revegetation areas.

What's inside?

2-3 Natural Features

Life zones, water, mountains, glaciers and more.

4 Environmental Factors

Defending against alien invaders and harnessing the power of fire.

5 Plants

From tiny lichen to giant trees and restoring natural habitats.

6-7 Animals

Bats, bears, birds, fish, ducks, wolves and goats that aren't goats.

For more information about North Cascades National Park visit <http://www.nps.gov/noca>

Life zones in the North Cascades

Alpine Zone: Above 7000' only the most hardy survive the harsh elements and lack of water and soil. Sedges and grasses in the meadows are interspersed with alpine flowers.

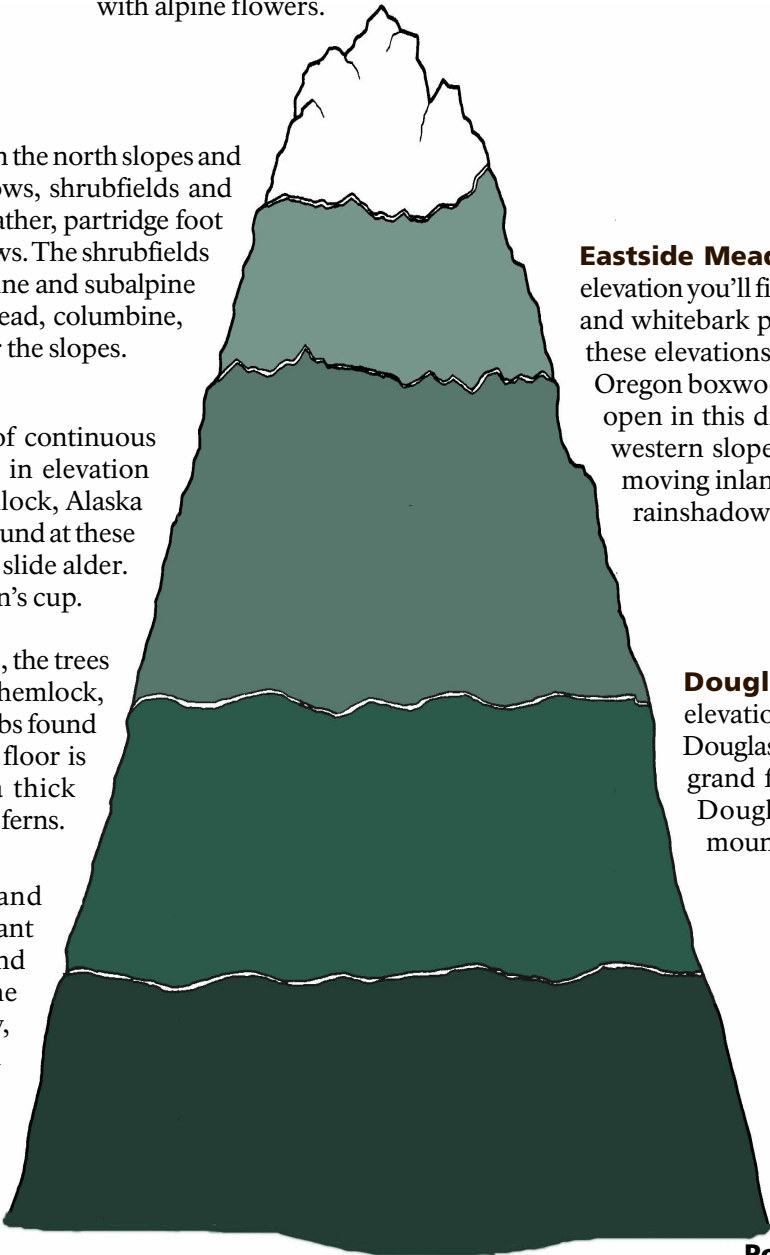
Westside Forests

Subalpine Zone: At 5000' to 7000' in elevation on the north slopes and throughout the North Cascades you find meadows, shrubfields and patches of stunted trees. Fragile plants such as heather, partridge foot and Sitka valerian flourish in high elevation meadows. The shrubfields include slide alder and false azalea. Numerous alpine and subalpine flowers like phlox, Indian paintbrush, elephant head, columbine, Davidson’s penstemon and mountain lupine cover the slopes.

Mountain Hemlock Zone: The highest area of continuous forest on the west side, 4000' to 5000' or more in elevation depending on exposure, includes mountain hemlock, Alaska yellow cedar, pacific fir and subalpine fir. Shrubs found at these elevations include false azalea, mountain ash and slide alder. Understory plants include twisted stalk and queen’s cup.

Silver Fir Zone: At mid-elevation, 2000' to 4000', the trees found are primarily the pacific silver fir, western hemlock, western redcedar and sometimes Douglas fir. Shrubs found here are huckleberry and false azalea. The forest floor is similar to the Western Hemlock Zone, with a thick understory including Oregon grape, salal and many ferns.

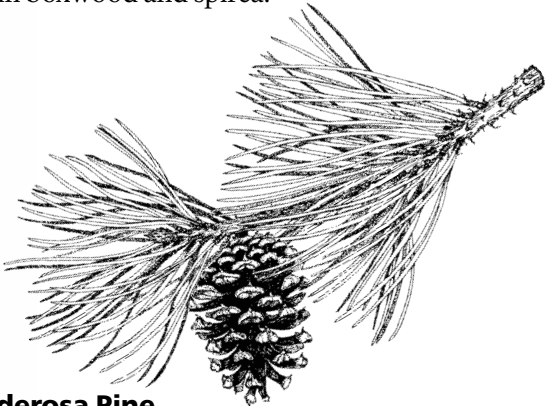
Western Hemlock Zone: Consists of lowland forests along the west side river valleys. Dominant trees are western hemlock, western redcedar and Douglas fir. Shrubs and ground cover include vine maple, red huckleberry bushes, thimbleberry, sword fern, trillium and foam flower. In undisturbed areas the ground, tree trunks and branches are covered with mosses, mushrooms and lichens. The cool moist maritime climate provides plenty of rainfall, maintaining this forest community.



Eastside Forests

Eastside Meadow & Subalpine Fir Zone: At 4000' to 6500' elevation you’ll find subalpine fir, Engelmann spruce, subalpine larch and whitebark pine mixed with a variety of other trees. Shrubs at these elevations are cascade mountain ash, white rhododendron, Oregon boxwood and huckleberry. The understory is much more open in this drier community due to less precipitation than on western slopes. The mountains act as a barrier against wet air moving inland off the Pacific Ocean and Puget Sound casting a rainshadow across the eastern slopes.

Douglas Fir & Lodgepole Pine Zone: This mid-elevation, 2000' to 4000', eastside community is primarily Douglas fir and lodgepole pine mixed with Ponderosa pine, grand fir and western larch. The understory consists of Douglas maple, oceanspray, bitterbrush, pine grass, mountain boxwood and spirea.

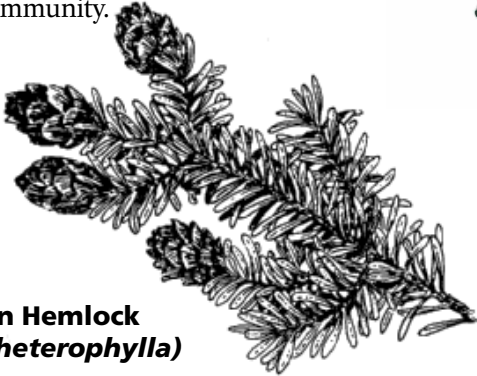
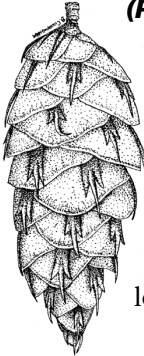


Ponderosa Pine
(Pinus ponderosa)

Ponderosa pine needles grow in bunches of two or three and are the longest of any pine in Washington. A large tree, 170' tall and 3' in diameter, it grows best on well drained soils and is extremely drought resistant.

Douglas fir
(Pseudotsuga menziesii)

This coastal variety of Douglas fir is common in the low to mid elevations of North Cascades and grows rapidly up to 300' tall and 6' in diameter. This tree thrives best in areas cleared by fire where sunlight is plentiful. Needles are single along a twisted stem, resembling a bottle brush. Brown distinct cones have characteristic three lobed bracts extending beyond the scales.

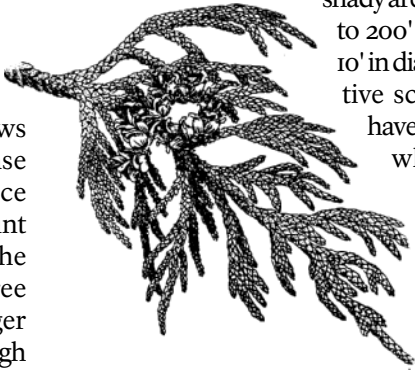


Western Hemlock
(Tsuga heterophylla)

The “State Tree of Washington” commonly grows with other trees due to its ability to thrive in dense shade. Young trees often start on “nurse logs,” hence the phenomenon of straight rows of trees. Flat, blunt needles have two fine white lines underneath. The small rounded cones help easily distinguish this tree from the mountain hemlock, which has much longer cones and often grows as a low sprawling shrub on high wind-swept slopes.

Western Redcedar
(Thuja plicata)

Among the native peoples of the region, the redcedar had many uses including clothing, shelter, rope, nets, tools and more. Redcedar thrives in moist, shady areas and can grow up to 200' tall and more than 10' in diameter. The distinctive scale-like needles have a resinous odor when crushed. Small upright cones are scattered near the branch ends, while the trunk is fluted with stringy bark.



Wildlife zones

Western Low Conifer

While enjoying these lowland forests along the highway stop, look and listen for spotted, barred and great horned owls, ruffed grouse, band tailed pigeon, Vaux’s swift, pileated woodpecker, Steller’s jay, winter wren, golden-crowned kinglet, Swainson’s thrush, red-legged frog, ensatina, Townsend’s chipmunk, Trowbridge’s shrew and long-legged myotis.

Montane Mixed Conifer

This mid-elevation zone stretches from 2,000’ to 4,000’. Inhabiting birds include Barrow’s goldeneye, red-breasted sapsucker, mountain chickadee, red-breasted nuthatch, winter wren, dipper, MacGillivray’s warbler, cascades frog, roughskinned newt, mountain beaver, elk and mule deer.

Subalpine Parkland

Typical inhabitants include blue grouse, rufous and calliope hummingbirds, three-toed woodpecker, Clark’s nutcracker, hermit thrush, Townsend’s warbler, hoary marmot, wolverine and pacific giant salamander.

Alpine Grass- and Shrublands

A few hardy species use this high-elevation zone including white-tailed Ptarmigan, black swift, common raven, horned lark, American pipit, mountain goat, and long-toed salamander.

Eastside Mixed Conifer

This upper-elevation zone on the eastside of the mountains is home to the western screech-owl, common nighthawk, Hammond’s and dusky flycatchers, pygmy nuthatch, house wren, big brown bat, masked shrew, red squirrel, deer mouse and white-tailed deer.

See if you can identify what zone you are in by the animals and plants you observe.

Notice gradual zone changes—you should be able to predict what animals you may see from the types of vegetation surrounding you.



Spawning salmon

NPS photo

Watershed lifecycles

Water is the life force of the North Cascades. It falls from the sky, melts from glaciers, trickles off mountains, replenishes lakes and flows to the sea.

Within the Puget Sound Watershed, the Skagit is the largest and most bountiful river. With its 2,900 streams, the Skagit River Watershed accounts for one third of the water that empties into Puget Sound.

All five species of salmon and four species of anadromous (sea-run) trout begin life in the cool gravel bottoms of the Skagit watershed where they feed on a healthy macroinvertebrate population. These tiny aquatic insects may not have a spine but they are the backbone of the river ecosystem.

On average, 330,000 pink and 30,000 coho salmon return yearly to spawn in the Skagit. In odd-numbered years like 2001, as many as 40,000 chum salmon may return. The 2001 run brought 894,000 pink, approximately 75,000 Coho and 62,262 Chum .

The Skagit and other watersheds of the North Cascades are habitats that attract one of the largest winter gatherings of bald eagles in the lower 48 states. More than 500 birds spend the winter along the river. The eagles travel here to feed on spawned-out salmon carcasses that sustain them through the winter. In turn, the eagles help cleanse the river and return the nutrients in the fish to the land.

This key life cycle reminds us that nature’s recycling and clear, clean water are critical to survival.

Glaciers in the Cascades

Understanding Nature’s Frozen Sculptors

One of the most striking features of the North Cascades is the incredible number of glaciers in the region. Boasting more than 300 glaciers and countless snowfields, the North Cascades National Park Service Complex is the most heavily glaciated area in the United States outside of Alaska.

The glaciers are a vital component of the North Cascades ecosystem. They influence soil development, vegetation distribution and flooding and are unique indicators of climatic change.

Glaciers are formed when more snow accumulates in winter than melts or evaporates during the following summer. The immense weight of this continuous buildup causes the snow to compact into ice, which then slowly moves downhill.

As glaciers move, they gouge and scrape the landscape, continuously redefining it. Mountains may appear to be in suspended animation, but like everything else, they are in a continuous state of change.

The North Cascades glaciers are disappearing. Since the mid-19th century, most glaciers in this area have shrunk dramatically. This is due to the combined effect of less precipitation and warmer summers.

More than 90 percent of the North Cascades glaciers could disappear within 40 years if the annual temperature increases by 2 degrees Celsius (3.6 degrees Fahrenheit).

People in the North Cascades recognize that if glaciers continue to shrink, substantial adjustments to lifestyles, agriculture and industry will be necessary. Salmon and other aquatic life also would encounter difficulties if the glaciers disappear.

Life changes as a result of climate change; glaciers mirror these trends. Glaciers are indicators of climate changes such as temperature and precipitation. As reservoirs of snow from past winters, they can show concentrations of airborne pollutants trapped in their ice.

Subsequent snow melt may wash the pollutants into lakes and streams where they are absorbed by insects and move through the food chain affecting everything from amphibians to fish and fish eaters including humans.

Several related projects are helping scientists understand the ecological importance and changing nature of the park’s glaciers. Data collection on the Noisy, Silver, North Klawatti, and Sandalee glaciers provides valuable information about the climate of the North Cascades as well as the amount and timing of meltwater released by glaciers.

Through these studies, park managers are developing a greater understanding of the glaciers’ ecological role and function and are educating the public.

For more information visit www.nps.gov/nocal/massbalance.htm and <http://www.earthwatch.org/expeditions/skagit.html>.



Willey Lake Photos by Alex Brun

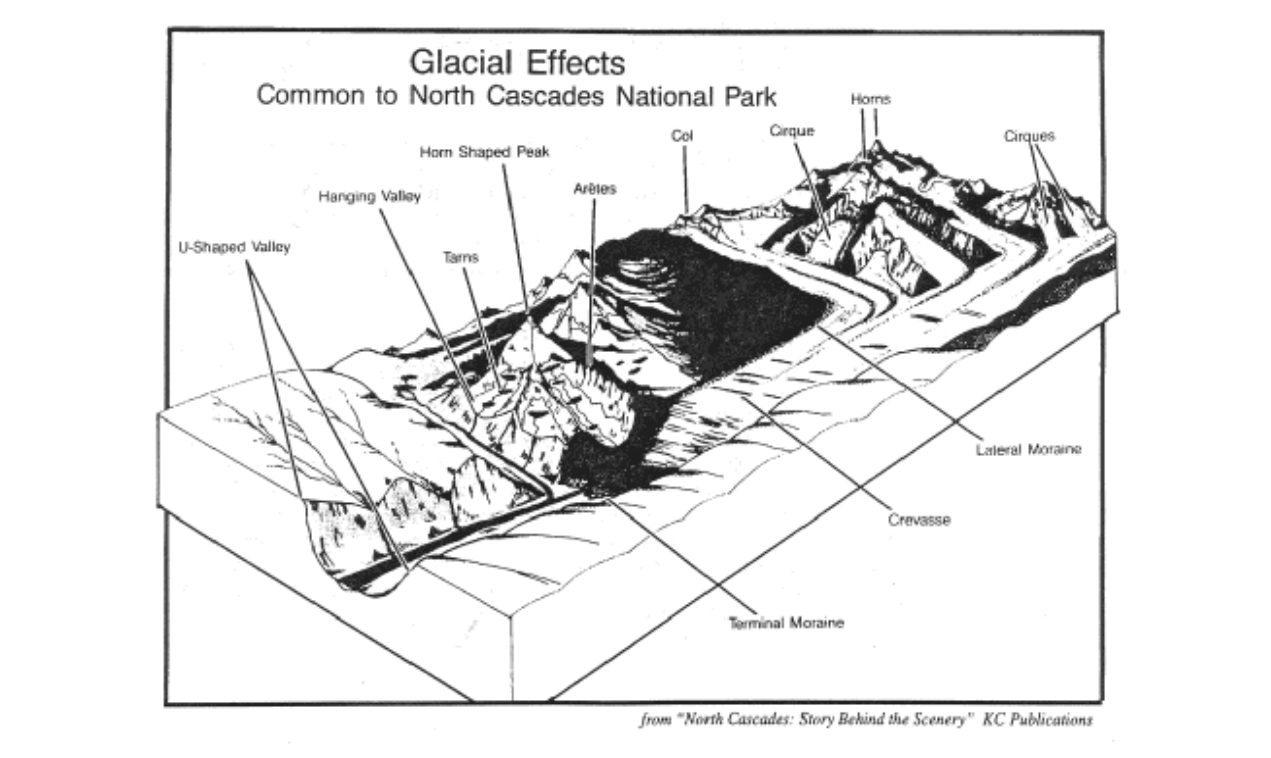
Mountains in motion: an ever-changing environment

The North Cascades are still rising, shifting and forming. Geologists believe that these mountains are a collage of terranes, distinct assemblages of rock separated by faults.

Fossil and rock magnetism studies indicate that the North Cascades terranes were formed in other places, some many thousands of miles south of here. Attached to slowly moving plates of oceanic rock, they drifted northward merging together about 90 million years ago. Exactly when they arrived here is still in question.

Colliding with the North American Continent, the drifting rock masses were thrust upwards and faulted laterally into a jumbled array of mountains. The collision broke or sliced the terrain into north or south trending faults that are still evident today where State Route 20 (SR 20) crosses the Straight Creek fault just east of Marblemount.

Geologists believe the rocks to the west of the fault slid more than 100 miles north of the slice to the east. The rocks to the east of Straight Creek Fault are gneisses and granites, while those to the west are completely recrystallized mudstones and sandstones. Over time, these precursors to today’s North Cascades were further faulted and eroded to a nearly level plain.



Carved by ice

The fantastic jumble of serrated ridges, saw-toothed peaks and deep cirques is the result of several ice ages. Fifteen thousand years ago vast sheets of ice reached from central British Columbia into what are now the North Cascades. As the gigantic glaciers advanced they dragged rocks ranging in size from grains of sand to house-sizes boulders, sculpting and scouring the landscape beneath them. Glacial sculpting continues to-day on a smaller scale. Glaciers leave behind these mountain features:

- **Cirque:** Horseshoe-shaped recess at the head of a valley. (e.g. Horseshoe Basin, Boston Glacier, South Cascade Glacier)
- **Arete:** Saw-tooth ridge formed between adjacent cirques. (e.g. Ripsaw Ridge, South Picket Range)
- **Horn:** High pyramidal peak formed by cirques on three or more sides. (e.g. Mt. Shuksan, Forbidden Peak)
- **Tarn:** Deep rounded lakes occupying evacuated cirques. (e.g. Doubtful Lake, White Rock Lakes, Hidden Lake)
- **Moraine:** Accumulation of rock material on or around a glacier, derived from rockfall and from erosion of the valley sides by the glacier.



Luna Peak



Mt. Challenger

Combining air and water

Water and air form the foundation of the North Cascades ecosystem—changes in their quality affect everything. Water and air are almost inseparable, as water travels through air and air travels through water. The water cycle - precipitation, saturation, evaporation, and condensation - links air and water.

Salmon and trout, in order to survive, require relatively high levels of oxygen in their water—the water must be aerated.

Glaciers and snowfields in the North Cascades are links in the cycle of water and air. Meltwater from this ice and snow flows down streams, creeks, rivers to estuaries and on to the ocean. From the ocean, water evaporates and travels as clouds, which are blown into the mountains, depositing their water as snow or rain. The cycle is never broken.

North Cascades National Park air quality is rated Class I, or “most pristine—a rating which the National Park Service works to maintain. Resource Managers monitor ground-level ozone and other indicators of air quality from stations at Marblemount, Lake Chelan, and Ross Lake. Rainwater is tested weekly to determine levels of acidity and chemical content.

Existing water quality within North Cascades National Park Service Complex is believed to be excellent. However, the waters do receive acid deposits and other air pollutants. Air pollution from vehicles, industry, wood-burning, and other sources can end up in snowfields, glaciers, and throughout watersheds. These airborne pollutants are deposited by rain and snowfall, and by the air itself. Rivers, lakes, and streams are monitored regularly for chemical content. Macroinvertebrate samples are taken in order to gauge water quality.

For more information pick up the Air Quality brochure or visit the website at <http://www.nps.gov/nocal/air.htm>



Above: Prescribed fire used to restore altered Ponderosa Pine ecosystem. Below: Glory Mountain Fire in the Flat Creek drainage during 2001. NPS photos

Prescribing flames for preservation & protection

Fire plays a vital role in maintaining and restoring natural ecosystems in North Cascades National Park. Fire in the wrong place, however, can result in the loss of life or dwellings and can alter natural vegetation types.

In order to allow this important and powerful disturbance agent to continue diversifying vegetation, while keeping unwanted fires from resulting in tragic losses, the fire management team carefully weighs potential benefits and losses in each fire management decision.

The park’s fire team is comprised of personnel with expertise in fire ecology, suppression strategies, prescribed fire, silviculture planning and program management. Fire management personnel work closely with other park resource specialists and the public to develop and implement management and operational plans.

The fire team cooperates with neighboring agencies to provide assistance in meeting program goals. All options for fire suppression are considered: lightning fire management, prescribed fire for thinning small-diameter trees, community protection and restoring fire-dependent ecosystems.



One hundred and ninety-three acres of ponderosa pine and Douglas fir have been burned and 40 acres have been thinned to reduce the fire threat to Stehekin. Additional treatment is planned for the area and in Hozomeen. All thinning treatments are closely monitored by fire personnel.

Through long-term monitoring, treatment effects are recorded and used to measure progress toward meeting fire program goals.



Herb Robert



Herb Robert (*Geranium robertianum*)

This alien invader is a shade tolerant, low growing geranium that’s described as a winter or spring annual. Spread by seeds this alien plant can reach heights up to 10 inches. The stems are often dark red and covered with white hairs. A somewhat sticky or oily feel and a distinct odor from the crushed leaves are attributed to these hairs.

The stems fork at the nodes where a pair of long-stemmed, deeply dissected leaves branch out, giving the overall plant a fern like appearance. Flowers are found from early spring to fall and range in color from magenta to pink to white.



Spotted Knapweed



Spotted Knapweed (*Centaurea biebersteinii*)

An eight to 48-inch-tall perennial with a stout tap root, knapweed appears hairy and rough—almost woolly at times.

The leaves are blue-gray and divided once or twice into lobes on each side of the center vein. Overwintering rosettes grow in early summer producing 1-15 stems. The pink to purple flowers occur in egg-shaped heads which are at the ends of clustered branches.

Knapweed flowers from June to October producing approximately 400 seeds per plant. A very aggressive species, knapweed can infest large areas very quickly.

Japanese Knotweed (*Polygonum cuspidatum*)

This plant can grow to eight feet high, often appears shrubby and has reddish, bamboo-like stems, which are smooth and hollow.

The stems die back each year at first frost leaving tall, brown skeletons. The leaves are alternate, between four and six inches long and usually egg shaped. Small individual flowers bloom in late summer and are whitish to greenish, forming drooping clusters. Knotweed prefers moist, open, sunny locations but can grow on dry sites, as well.

Spread is attributed to rhizome fragmentation rather than seeding. Once established the knotweed forms deep, thick mats obstructing root removal.



Japanese Knotweed

Practicing the three R’s

Rehabilitation, Restoration, Revegetation

Restoration of the Goodell Creek Gravel Pit began in October 2001 along part of the east side of Goodell Creek. The National Park Service is implementing ecological restoration on approximately 0.6 acres of the 6-acre former gravel pit near Newhalem.

The park, with funds from the Washington State Department of Transportation, will plant the area with a variety of native trees and seeds.

The spectacular 2001 fall salmon run in Goodell Creek reflects the importance of this stream. Restoration of the riparian zone will provide a continuous wildlife corridor along the east bank of the creek from the Skagit River to its headwaters, and will improve salmon habitat by creating a buffer zone along the creek.

The 0.6 acreage includes the gravel pit segment located closest to Goodell Creek where drain rock and sand were stockpiled. Without plant cover this area could erode and be readily invaded by alien plants, such as Japanese knotweed.

In another restoration effort the park needs visitor help. Rehabilitation efforts are taking place in spots along Ross Lake. The NPS recently built log cribbing and rock walls, and planted native species in order to stabilize erosion.

Unfortunately for the new plants, the Ross Lake area is a relatively dry part of the North Cascades National Park Service Complex. These new plants thrive better if watered in the first two years after planting. You can help by using the watering cans provided along the edges of revegetation sites.

For more information on these projects pick up the *Ross Lake Rehabilitation* or *North Cascades Revegetation* brochures at the Visitor Center or other NPS office.

Volunteer!

Volunteers are a critical part of revegetation, both in the greenhouse and in the field. To find out more contact:

- Marblemount Ranger Station (360) 873-4500 ext. 36 or 54
- Wilderness Information Center (360) 873-4500 ext. 39

Alien plant invasion

Alien plants may be exotic, but they are unwelcome in North Cascades National Park. Exotic plants threaten the ecosystem integrity of the area. Alien invaders such as knapweed, skeletonweed and scotch broom thrive in areas impacted by humans.

Exotic plants can be brought in as seeds attached to vehicles, pets, cargo or spread by rhizomes such as Japanese knotweed. Often plants like English ivy, holly and herb robert are brought in to beautify an area, but are detrimental to native species.

Because of their shade tolerance and adaptability, alien plants are more successful than natives at colonizing human-disturbed areas. Without controls, such as competing plants and predatory insects, alien species flourish and out-compete native plants.

Over thousands of years, more than 1,500 native plant species have adapted to successfully fit habitats of the North Cascades. Though hardy enough to survive natural disturbances such as fire, most native plants do not fare as well in areas changed by humans. To preserve the native landscape, the National Park Service and USDA Forest Service use a range of techniques to control alien plant invasions.

This summer a team of National Park Service exotic plant managers will partner with the Forest Service and the Nature Conservancy to eliminate weeds throughout the area. To limit environmental damage most weeds are removed by hand. This is extremely work intensive because seeds of some exotic plants can lie dormant in the soil for up to seven years.

Exposing alien plants to predators and diseases from their homeland can also help control their spread. These natural controls have not been found to attack plants native to the North Cascades.

In 1994, two species of gallfly, which feast only on knapweed seeds, were used to help limit an infestation in the Lake Chelan National Recreation Area. Though biological control usually does not eliminate alien species, it can slow down the rate of invasion.

When mechanical and biological attempts to control alien plants such as skeletonweed fail, the NPS may employ chemical controls. Because herbicides can cause unwanted damage to native plants and animals, their use is carefully evaluated and administered. Continued efforts to control alien species will help protect natural plant communities in the North Cascades.

The fungus among us

Little is known about the ecological role of fungi even though they play a key role in the forest community. Fungi decompose brush and dead or diseased trees releasing nutrients back into the park ecosystem. Mushrooms—the fruiting bodies of fungi—are food for many woodland critters including deer and squirrels. Between 600 and 800 species are estimated to exist in the park. A photographic survey currently underway has documented 125 species so far.

A little known but important role some species of fungi play is their interdependent relationship with plants. Fungi absorb phosphorus and nitrogen from the ground and provide these nutrients to plants. Plants return the favor by providing simple sugars.

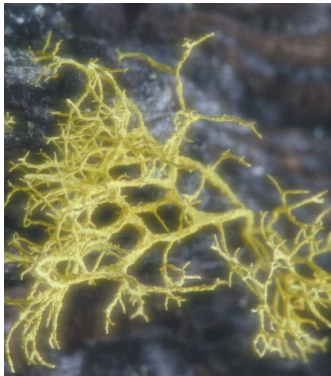
Fungi are also known to be sensitive to air quality, which adds to their ecological importance. North Cascades National Park has developed a photographic inventory of fungi to better monitor them within the park.

For more information visit <http://www.nps.gov/noca/rescat/rescat7a.htm> or ask for the mushroom site bulletin.

Note: Mushroom collecting is prohibited within North Cascades National Park Service Complex. Check at ranger stations for more information.



Princess Amanita



Lichen



Polypore or conks

NPS photos

Those likeable lichen

Although rangers don’t often gossip, you might hear us talking about Alice Algae, who took a likin’ (lichen) to Freddie Fungus. But you probably knew that, didn’t you? After all, they are seen together frequently.

They (algae and fungus) are two independent organisms that join together in mutualistic symbiosis to form one composite life form—the lichen. Mutualistic symbiosis is a term biologists use to describe a relationship in which each organism benefits from the other’s presence—a partnership of sorts. However, the partnership is a debate—some lichenologists dispute how beneficial the relationship really is to the tiny, single-celled forms of algae involved.

Algae have the ability to create food through photosynthesis but are vulnerable to the elements. Fungi are not green because they lack chlorophyll and are unable to photosynthesize. When alone they are usually found in the form of mold, mildew or mushrooms that are better adapted to environmental extremes, but must invade or scavenge for food.

When found together, algae provide carbohydrates to their fungal partner and fungi provide protection to their algal partner.

Together, they exploit habitats where they could not survive independently. As a result, the forest in the North Cascades is literally covered with lichens. They are on trees, rocks and even old buildings. They alone display a rich diversity of forms, which to many observers is the beauty of lichens.

Lungwort (*Lobaria plumonaria*) looks like a rubbery piece of lettuce and is easy to find scattered on the ground, especially after a windstorm has knocked it out of the canopy above.

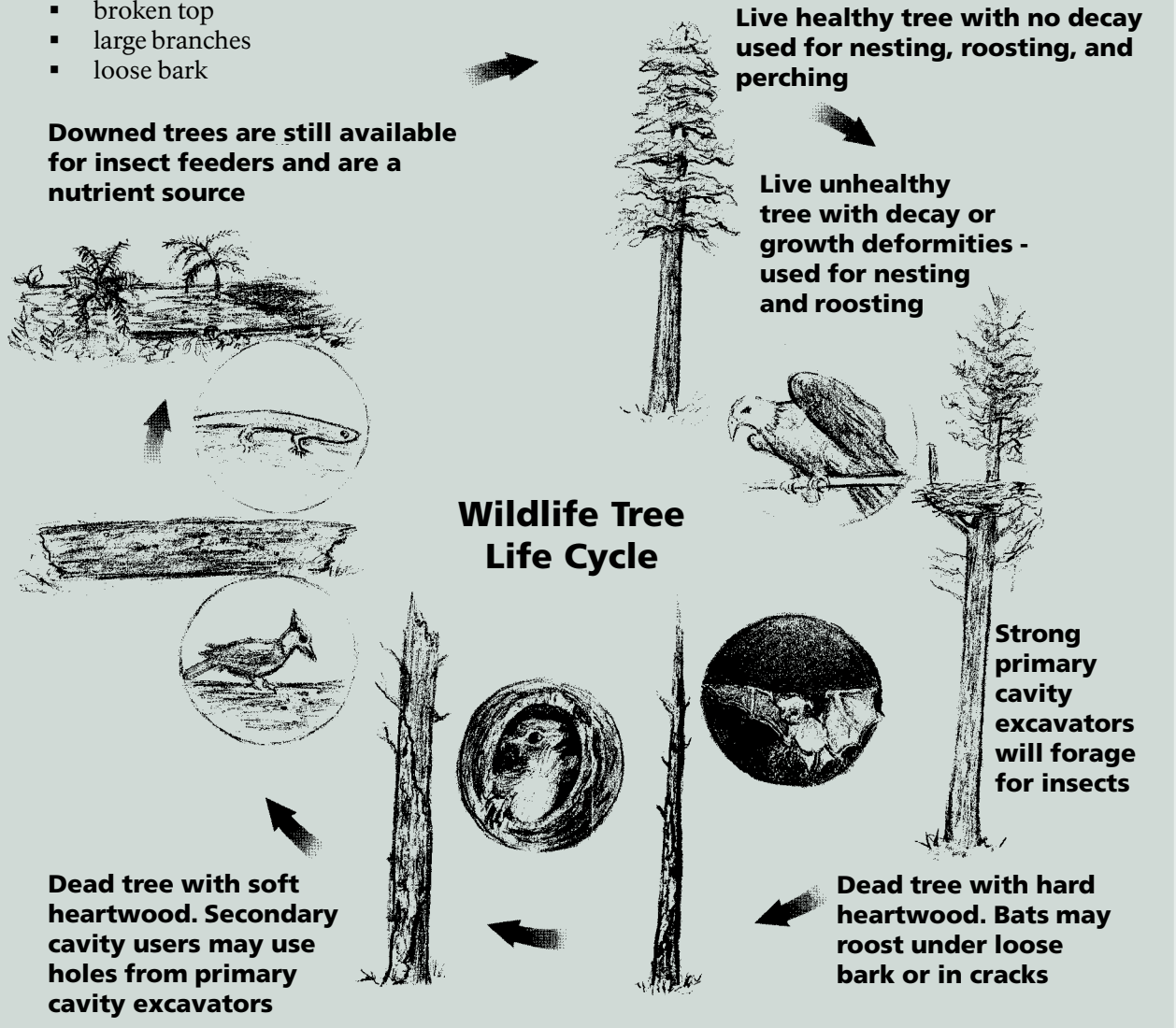
Common witch’s hair (*Alectoria sarmentosa*) looks like green, stringy hair hanging from tree branches. Lichen provide food for animals such as flying squirrels and material for bird nests and also act as nitrogen fixers for the forest.

Wildlife trees

A wildlife tree is any standing tree, dead or alive, with special characteristics that provide habitat for wildlife. Some of these characteristics are:

- large size
- hollow trunk
- broken top
- large branches
- loose bark

Woodpecker cavities, nest sites and birds perching on the branches are obvious signs of wildlife use. Bat guano under loose bark or bear fur around a hollow trunk are less obvious signs of use.



Hazard trees: every stump is a management failure

Nothing can put a damper on your day quite like the plummeting limb of an old growth Douglas fir tree. In fact, it can kill you.

Hazard trees are not something most campers think about, but we take their threat very seriously.

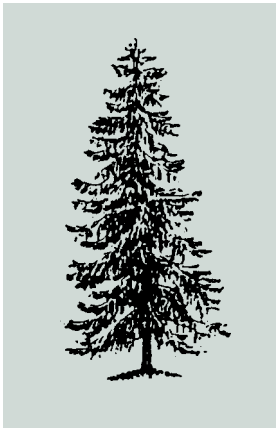
Each year we meticulously monitor the risks of hazard trees in all front country campgrounds, trails, and other visitor use areas.

Is there a target? Is there a limb perched precariously over a tent pad? Is the trunk hollow from heart rot?

Unfortunately, the science of hazard tree identification is not exact.

When a storm rolls through and the wind kicks up, trees and limbs can fall in very unpredictable ways. With careful monitoring we can reduce the risk, but we cannot eliminate it entirely.

Our goal is to minimize danger by reducing threats while protecting aesthetic values and habitat functions.



Fortunately, there are many ways to reduce risk without cutting down trees. We can climb the tree (no easy task!), and cut the offending limb or top, leaving the tree standing for generations of park visitors to enjoy.

In certain instances we may even go beyond simple trimming and create “habitat trees” by carving out nesting cavities and other niches for animals to nest or roost.

Next time you set up camp, take a good look around and see if you can spot our hazard tree handiwork.

For more information about hazard tree management, please contact Roy Zipp, Natural Resource Specialist. He can be reached by telephone at 360-873-4590

ext. 31 or via e-mail at roy_zipp@nps.gov. Also, find out what “snags” are and why they are important to the forest ecosystem at <http://www.nps.gov/noca/snags.htm>.

Revegetation in fragile highcountry meadows

From the vibrant red of Indian paintbrush to the more subdued pinks and whites of heather, the hues of a mountain meadow in full bloom can take your breath away. But walking off trail into a mountain meadow damages plants and disturbs the animals who live there.

Highcountry plants are especially fragile and sensitive to disturbance, in part due to short growing seasons at high elevations. The weather is harsh and snow lingers more than half the year.

Plants like heather and huckleberry break easily. Hiking off trail causes plant damage, soil compaction and erosion. Compaction depletes the soil of air and water, which are essential for plant growth. Animals need the plants for food and cover.

Damage to such fragile ecosystems can take hundreds of years to recover naturally, if they ever do. Once an area loses its vegetation, soils are exposed to erosion. If soils are lost, an area may become permanently barren.

Unfortunately, such delicate meadows and passes are popular highcountry spots. Some have been overused and are worn to bare ground. In several alpine areas park Resource Managers have placed netting to cover trail scars and protect seedling transplants.

Another facet of revegetation begins in the fall with seed and cutting collection. These are taken to the native plant nursery in Marblemount and grown through at least one summer. Each flat is carefully labeled so that plants



Pink Mountain Heather

Photo by Anne Braaten

can be returned to the same meadow where the seed was collected. Other methods of revegetating include direct seeding and use of transplants from nearby trail and facility construction.

Volunteer groups are assisting park staff in many projects. Currently Copper Ridge, Cascade Pass, Easy Pass and Juanita Lake areas are undergoing revegetation. Signs or exclosures mark the revegetation areas. You can help by staying out of these areas and walking only on designated trails. For more information pick up the *North Cascades Revegetation brochure*.



Mountain goats are right at home in the rugged high-altitude environments of the North Cascades.

NPS photo



A large male black bear takes a leisurely stroll through the foliage at Park Creek Pass.

Photo by Kevin Thurner

Black bears & grizzly bears a key link in salmon lifecycle and forest ecosystem

Twilight is falling along the river, where the shadows of high peaks began creeping by late afternoon. Standing in the mud of a quiet pool, a bear—a shadow itself in the gathering evening—reaches into the water. It scoops up with dexterous paws the spawned-out carcass of a salmon.

Grasping the fish in its mouth the bear moves several meters into the security of the riverside brush before settling down to eat. To the unseen observer across the water the bear seems to melt into those silent willows, bear and fish both ghosts in the blue-cast light of dusk.

This scene is played out wherever grizzly and black bears share the landscape with salmon. It is a story of marvelous symmetry, in which the salmon and bear nurture each other.

Bears through the ages have scooped from wild rivers the tired or dying salmon that had returned to spawn. Seeking security, some bears carry their meals a distance from the river. Others feed while in or near the water.

On shore, their leftovers feed many organisms, from ravens, eagles, foxes and coyotes which scavenge them, to the microbes and insects that finish them off.

The distribution of the fish back into the earth continues wherever bears and scavengers relieve themselves—scattering fish fertilizer throughout the forest.

The same occurs within the river: microbes and aquatic insects break down bears’ fishy feces, as well as the remaining salmon carcasses. The return of these nutrients to the earth fertilizes the riparian forest, which in turn protects the next generations of salmon by reducing erosion and providing cooling shade to spawning streams.

Nutrients returned directly to the water nurture developing salmon eggs, strengthening them and allowing more to flourish.

The salmon’s decline disturbed this cycle, but although salmon may never regain their former glory, it is yet possible to mend this tear in life’s web. In the meantime, bears are resilient. They eat most anything, and the North Cascades provide fine habitat.

With effort on our part, both bears and salmon will have a long future together in these wild mountains - and in the hearts of people for whom both life forms hold spiritual meaning as deep as the shadowed river valleys.

Have gray wolves returned to NOCA?

Gray wolves roamed North America coast to coast for 10,000 years until they were hunted and trapped to near-extinction by fur traders, settlers and government sponsored eradication programs.

After a long absence wolves were reported roaming along the Canadian border since 1984. Adult wolves were seen with pups in 1990 and finally a wolf was captured on film near the Hozomeen in 1991.

The wolves had returned ... or so it seemed.

In the decade since, the park has worked largely without success to document the presence of wolves in the North Cascades. Tracks or audible signs of wolves are evidenced each year, yet these notoriously shy and intelligent animals have not been caught on film since Biologist Scott Fitkin photographed one in 1991.

Other forms of monitoring such as howling surveys do indicate, however, that wolves may be in the early stages of recolonizing the North Cascades.

If wolves have returned, they most likely migrated south from Canada where they are more common.

Habitat loss and hunting pressure to the north may have been the driving factors behind gray wolves returning to the North Cascades.

Whatever the case, wolves are a welcome addition to the park’s ecosystem. They strengthen the vigor of prey population such as elk, deer, beaver and marmot by removing the sick, weak, diseased and injured.

Most places where wolves roam, people are completely unaware of their presence. If while visiting the park you do happen to see a wolf or its sign, report it immediately by calling the wolf hotline at 1-800-722-4095. Take pictures or make notes as soon as possible, making sure to record the location.

To learn more about wolves in the North Cascades visit <http://www.nps.gov/noca/wolf.htm>.

Mountain goats

The perfectly adapted ‘antelope’ of the Cascades

Amongst the crags and ridges of this wilderness dwell supreme mountaineers. Mountain goats, which are actually more closely related to antelopes than goats, are superbly adapted to the harsh conditions of the North Cascades.

They traverse the steep terrain aided by their strong muscular forequarters, scrambling over rocky slopes on split, pliable hooves with soft rubbery pads and a hard outer lining. Their compact bodies with thick, hollow hair and wool “subfur” help hold heat and repel the elements.

During the summer, many family groups make their home on Mt. Baker and numerous other peaks. These animals can sometimes be observed at a distance from Artist Point and other viewpoints.

Mornings and evenings they browse on huckleberry and shrubs. Mid-days they are more sedentary, often resting on snow banks during warm summer afternoons.

In winter, bands of goats move down to south facing ledges, where they gain some protection from harsh winter elements.

Solar exposure and valley winds allow goats to forage for lichen, grasses and shrubs on snow-free bluffs.

In the North Cascades, about 1,200 goats occupy a five county area. In contrast with the introduced goats that thrive on the Olympic peninsula, the native population in the Cascades seems to be dwindling.

In this area mountain goats experience 60-70 percent mortality in the first year of life and 50 percent during the second. Causes of death include avalanches, falls, predation (cougar, golden eagles) and poor winter conditions causing stress and parasite loads.

So where, specifically, are the mountain goats in the North Cascades? Park Resource Managers (and visitors) wanted to know.

Since capturing and tagging goats in rugged mountain terrain is dangerous for both goat and researcher, information about habitat was collected from backcountry users. These statistics were entered into a computer linked to a Geographic Information System (GIS). By combining geographic data with reported locations of goats, a map of probable habitat was developed.

This research helps resource managers assess potential impacts on mountain goats when evaluating proposed projects in the park such as trail construction and other development.

Visitor reports are invaluable and greatly appreciated. You can help our understanding of these fascinating animals by reporting sightings to park representatives.

Secretive carnivores

Study planned for elusive predators



American marten

NPS photo

Little is known about the population, distribution and abundance of mid-sized forest carnivores in the North Cascades National Park Service Complex (NOCA).

These elusive animals include American marten (*Martes americana*), Fisher (*Martes pennanti*), lynx (*Lynx canadensis*), wolverine (*Gulo gulo*) and bobcat (*Lynx rufus*).

Biologists have a vested interest in these rare and secretive mid-sized carnivores by virtue of their position at the top of the food chain. They are an important group of mammals to monitor because the health of their populations are dependent on the health of the organisms upon which they prey.

Field studies investigating the presence/absence of these species in NOCA are slated to begin during the winter of 2003. Non-invasive sampling methods such as motion-sensitive cameras will be used to detect and monitor the targeted species. The initial study is expected to continue for two years.

Evaluation of the information collected may form the basis of strategy for long-term monitoring of these clandestine predators.

Harlequin ducks

Harlequin ducks migrate annually to North Cascades National Park in April from Puget Sound and the Pacific Coast to breed.

These ducks have very specific nesting and rearing habitat requirements. They seek clean, cold, swift water and plenty of aquatic insects to eat, making them a prime indicator species for the pristine river habitats they occupy during a few months each year.

Twelve streams were recently identified as suitable habitat and surveyed by park biologists. Just 29 harlequins were observed using eight of the streams.

Harlequins are only brief visitors to the park. By early May they have paired up, established territories and built their nests. Soon after the eggs are laid the males return to the coast. Females remain in the park to incubate the eggs. Together the mothers and their newborn join the males in the salt water habitats by late August.

Though the ducks’ time in the North Cascades is limited, it is an important part of their lifecycle. Some concern exists that the population of harlequins may be affected by the cumulative impacts resulting from habitat loss in the upper Skagit. Management policy and resource use have potential consequences for this colorful species and great care must be taken to protect their breeding habitat.

Cascades: home of the ‘Not-so-common’ Loon

Deep in the wilderness, at a wooded mountain lake, a haunting melodious call echoes off the cliffs. This is the home of the Common Loon (*Gavia immer*). If you are fortunate enough to see one, with its zebra-stripe necklace, glossy green checkerboard back, and sleek graceful form, you will discover that it looks as beautiful as it sounds.

The Common Loon breeds in the northern states and most of Canada and Alaska. Dramatic reduction in breeding numbers have made the term ‘common’ a misnomer. Washington has only a few known nests. Although dozens of loon pairs have been seen in the park, breeding wasn’t confirmed until recently.

Human activities have seriously impacted loons. Many birds accidentally drown in fishing nets or are illegally shot. Habitat modification, such as filling in wetlands and dams that vary water level, are also a serious threats.

Natural predation is also a threat. Adults are undoubtedly captured by the occasional mammalian predator while young loons are more vulnerable and can fall prey to predators like hawks, mink and turtles. Loons appear to have a stable breeding population and relatively secure habitat in the park. Because they are migratory, most spend part of the year in unprotected habitat.

Common Loons nest on the ground along the shores of lakes, on islands, or among wet soggy aquatic vegetation. Females lay one to three eggs in spring following acrobatic courtship behavior. After hatching, the fuzzy young leave the nest in just a few days and are able to swim, dive, and walk on land with ease.

Common Loons prefer to eat fish, but will settle for a frog, small reptile, insect, leech, or aquatic vegetation.

Natural Bug Zappers

Biologists at North Cascades National Park recently completed a three-year inventory project, which helped determine population status, species composition, distribution, and relative abundance of bats within North Cascades National Park.

Sampling sites in various habitats included low elevation forests, riparian areas, subalpine zone, buildings and caves.

Biologists collected data with ultrasonic bat detectors and by using capture-release methods. Information collected included species identity, sex, age, reproductive condition, weight, measurement of several morphological characteristics and recordings of each bat’s echolocation call.

During this study, biologists documented nine of the 12 species of bats thought to occur in the park complex. The Townsend’s big-eared bat, a Washington State threatened species candidate was found adjacent to the park boundary, while all the other species were found within the park.

Hozomeen goes batty!

It has long been known that bats occupy the Hozomeen maintenance building, but a recent evening outing discovered the building to house the largest known nursery colony in the park. The outing counted 1,642—a number that could be much higher.

A single bat can consume 2 grams of mosquitoes per night, times 1,642 bats equals 3.3 kilograms, times approximately five months of feeding equals 498.5 kilograms of insects eaten by this colony each year.

A rare grouping of five male harlequin ducks in breeding plumage.

Photo by Robert C . Kuntz II



A pair of loons show off their decorative plumage during the summer mating season.

Photo by Robert Morgan



Bird diversity

Birds are significant components of biological diversity within the North Cascades ecosystem. Over 200 species in 38 families can be found in park habitats that range from alpine meadows to low elevation forests and wetlands. Three species (bald eagle, marbled murrelet, and spotted owl) are listed as “threatened” under the federal Endangered Species Act. One of the largest wintering concentrations of bald eagles in the continental United States can be found along the Skagit River. From mid-November through February, hundreds of eagles come to the Skagit to forage on seasonally abundant salmon and waterfowl, and to take advantage of Puget Sound’s mild winter climate.

Birds reflect changes to our environments. By monitoring their populations, distributions, and such demographic attributes as productivity and survival, birds can serve as “early warning signals” for environmental problems occurring in and around the North Cascades.



Rufous Hummingbird

North Cascades neotropical breeders

Each spring, as part of an amazing phenomenon that happens across the continent, birds return from Central and South America to North Cascades National Park.

The Rufous Hummingbird, a familiar sight in suburban yards as well as the park, spends its winters thousands of miles away in southern Mexico. Swainson’s Thrush, a robin-like summer resident more often heard than seen in the park’s lower elevations, winters in areas stretching from central Mexico to northern Argentina and Paraguay.

Three-quarters of North America’s more than 650 bird species are migratory. Some birds that summer at North Cascades National Park accomplish impressive feats of long-distance flight and navigation each fall.

Unfortunately, as human population and development expand throughout the Americas, habitat for such ecologically important migratory bird species shrinks. Long-term studies show declines in many bird populations for which the U.S. National Park System provides critical habitat.

Indicator species in water

Macroinvertebrates are aquatic insects that have no backbone and can be seen with the naked eye. They live in ponds, rivers and streams often going unnoticed. Regardless of their small stature, macroinvertebrates are important as indicators of water quality and habitat condition:

- They live in streams not only year-round but for several years in some cases and are a good barometer of stream health.
- Macroinvertebrates live in streams and sections of streams where fish may be excluded.
- Relatively sedentary, macroinvertebrates are confined to specific areas and can’t flee pollution and other degradation.
- Each species has a different tolerance for environmental degradation. The assemblage of macroinvertebrates present can indicate a stream’s overall health or the type of degradation it may be experiencing.

Due to these useful attributes, North Cascades National Park is sampling areas to determine water quality and learn more about the biologic integrity of the many creeks, streams and rivers in the park.

To improve protection of these birds and their habitat, North Cascades National Park and other national parks around the U.S. and in Latin America have joined in the Park Flight Program—a coordinated approach to migratory bird conservation.

Funding from American Airlines, through the National Park Foundation, brought biologists from Central America to work with scientists in North Cascades National Park on refining methods for assessing the status and condition of migratory bird populations.

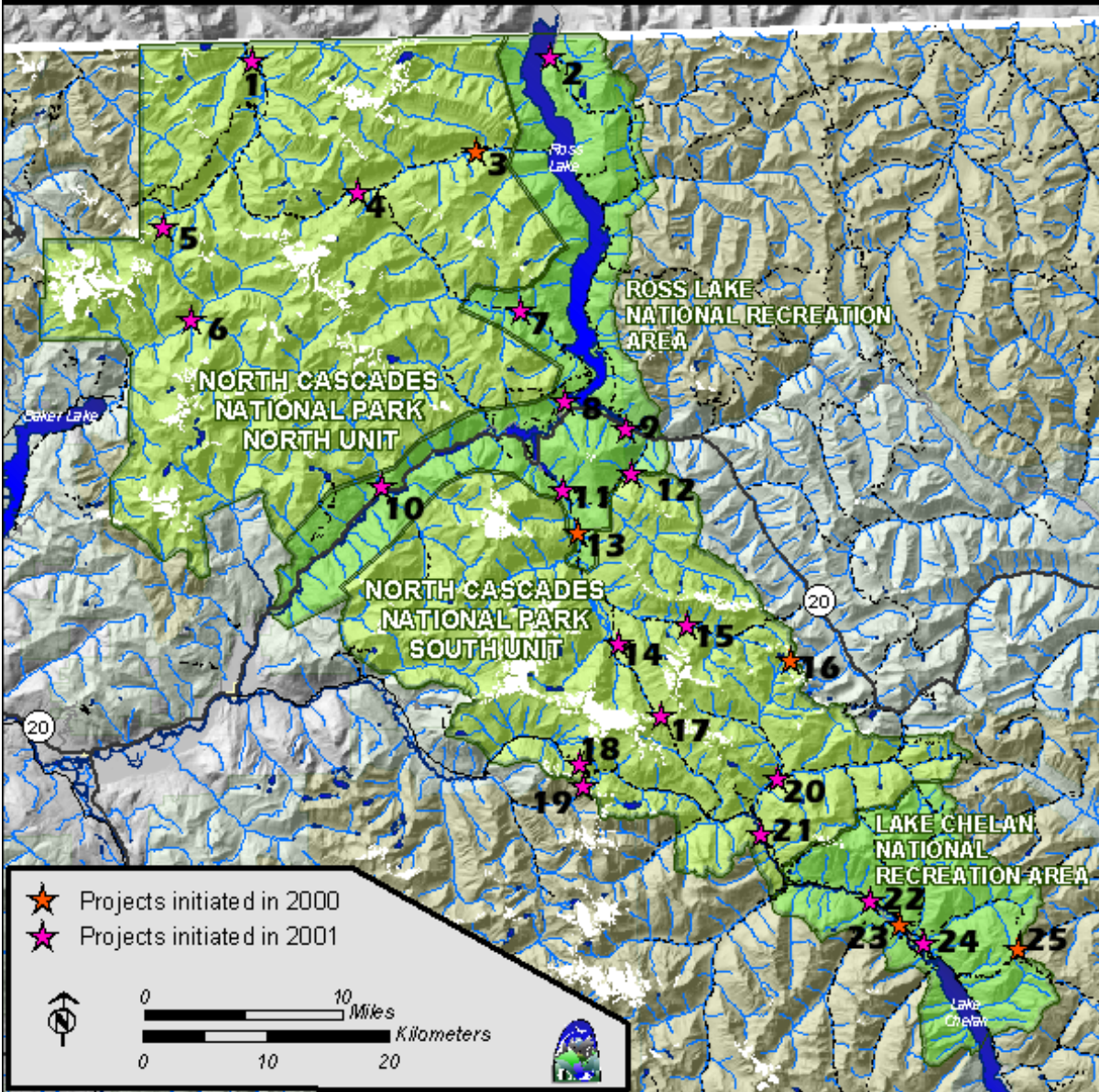
During their visit, the Central American biologists presented a public lecture and helped the National Park Service develop exhibits about birds that breed here and winter in the tropics.

We share with the citizens of Latin American nations some of the birds which most characterize the Northwest.

Survival of this important aspect of the North Cascades ecosystem depends on caring people protecting the habitat birds need in each season.

Research Permit Summary 2001

North Cascades National Park Service Complex



Research is an important activity in the national park. Many projects researching natural and cultural resources are happening throughout the park complex. Below is a short list of such projects in 2001, many of which are still ongoing. For more information go to <http://www.nps.gov/noca/rescat.htm>.

- 1 Lower Chilliwack Valley—Evaluation of scat-detecting dogs and DNA analysis from bear scats.
- 2 Hozomeen—Propertius duskwing butterfly study.
- 3 Forested Areas—Survey for macrofungi.
- 4 Multiple Sites Complex-wide—Genetic variation of *Ursus americanus* (black bear).
- 5 Hannegan Caldera—Structure and petrology of Hannegan Caldera (geology).
- 6 Upper Baker Lake Sub-basin—Baker River tributary habitat surveys.
- 7 Major Ross Lake Tributaries—Upper Skagit native char (fish) project.
- 8 Ross Dam—Devil’s Mountain GPS strain network.
- 9 North Cascades Highway Corridor—Occurrence of Lynx.
- 10 Goodell Pit—Goodell gravel mine restoration research.
- 11 Thunder Creek Watershed—Restoration of off-channel habitats.
- 12 Forested Areas—Forest inventory.
- 13 Thunder Creek—Fire and forest succession.
- 14 Complex-wide—Avian distributions and habitat relationships.
- 15 Thunder and Fisher Creeks—Rare carnivore camera study.
- 16 Black Peak Batholith—Black Peak Batholith emplacement and deformation (geology).
- 17 Stehekin and Thunder Creek Watersheds—Climatic variability, ecosystem dynamics and disturbance.
- 18 Thunder Creek, Cascade Pass and Panther Pass—Bird distributions and habitat relationships.
- 19 Mt. Formidable, Magic Mountain and Cascade Pass—Tectonics of Magic Mountain gneiss.
- 20 Agnes, Bridge, Flat and Park Creeks—Bull trout snorkeling surveys.
- 21 Stehekin River Drainage—Cutthroat/Rainbow trout hybridization.
- 22 Stehekin—Prescribed fire effects.
- 23 Stehekin—Women’s sense of place (social geography).
- 24 Stehekin—Rare plant population monitoring.
- 25 Lake Juanita and McAlester Mountain Areas—Decline of white bark pine.

World Wide Websites

Natural Resource Challenge
www.nature.nps.gov/challenge/NRC.htm

National Park Service
www.nps.gov

North Cascades National Park
www.nps.gov/noca/

- Air & Water Quality*
www.nps.gov/noca/air.htm
- Birds*
www.nps.gov/noca/birdzones.htm
- Fire*
www.nps.gov/noca/rescat/rescat2a.htm
- Fungi*
www.nps.gov/noca/mushroom.htm
- Geology*
www.nps.gov/noca/geology.htm
- Glaciers*
www.nps.gov/noca/glaciers.htm
- Leave No Trace*
www.nps.gov/noca/lnt.htm
- Natural & Cultural History*
www.nps.gov/noca/nat.htm
- Research Catalog*
www.nps.gov/noca/rescat.htm
- Restoration/Revegetation*
www.nps.gov/noca/rescat/rescat9.htm

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Editing, Writing, Layout
Cindy Bjorklund Tim Manns
Annika Mizuta Matt Williams

Contributors
Tod Johnson Ashley Rawhouser
Mignonne Bivin Roger Christopherson
Dan Allen Paula Ogden
Jon Riedel Robert C. Kuntz II
BC Parks

Photography
Robert Morgan Alex Brun
Kevin Thurner Harold Christenson
Robert C. Kuntz II

Nature and Culture: partners in preservation

With all this talk of mountains and glaciers, plants and animals it would be easy to assume that natural resources are all that makes North Cascades National Park the place it is. Not to be forgotten, however, are the vast cultural resources of the park.

Often times natural and cultural resources are intrinsically linked, often so much so that the line between the two can be difficult to distinguish.

Park Archaeologist Bob Mierendorf was one of the first to take a keen interest in the relationship early peoples of the region had with the mountains. His exploration has uncovered that early peoples used the mountains extensively for trade routes and hunting grounds, showing us that the link between natural and cultural resources is not an invention of modern times.

The park’s Cultural Resources branch is a critical partner in all research activities in North Cascades through the museum management program.

Resource Managers examine park archives and other collections before beginning inventory and monitoring programs. In finalizing projects, field observations are entered into databases and reports that are curated and documented into the museum collection. These activities ensure that the information that results from park research will be preserved and made available to other researchers.

The park recently completed a 950 square foot addition to the Marblemount Curation Facility more than doubling the size of the original building. A multi-park repository for NPS museum collections, the facility stores over 1.5 million museum objects for NOCA (including Ross Lake and Lake Chelan National Recreation Areas) and San Juan Island National Historic Park.

Museum collections housed at the facility include all natural history specimens—botanical, zoological, geological, paleontological and cultural resources—prehistoric and historic artifacts and archival documents. National Park Service (NPS) museum collections serve a variety of purposes:

- As documentary evidence of the natural and cultural resources within the park.
- As an educational tool for NPS staff, students, and the public.
- As a benchmark for short and long term environmental change.
- As a repository for artifacts, specimens and field documents that result from all research projects and serve as a basis for management decisions.

For more information, Contact Museum Curator Deborah Wood (360) 873-4590 ext. 19.



The Principles of Leave No Trace

Plan Ahead and Prepare
Always be aware of regulations and special concerns, such as revegetation, of the area you are visiting. Visit in small groups and avoid times of high use.

Travel and Camp on Durable Surfaces
Always camp in established campsites whenever they are present and stick to established trails to avoid trampling fragile vegetation and compacting soil.

Leave What You Find
Leave the wilderness as you found it so that others may enjoy it as you have. Do not alter campsites or build structures such as walls, tables or lean-tos.

Minimize Fire Impact
Whenever possible use campstoves instead of building a fire. If you do build a fire, be aware of regulations and use only small pieces of dead or downed wood.

Pack It In, Pack It Out
Repackage your food before departing to save space and weight and minimize potential litter. Leave nothing behind in the wilderness, including food waste. It is important that animals do not become dependent on unnatural food sources.

Dispose of Human Waste Properly
Use vault and compost toilets where available. In glacial areas pack out all solid waste. Check with ranger station for details on the various methods. In forested areas dig a “cathole” 6-8 inches deep at least 200 feet from water, trails and camps.

Respect Wildlife
You are a guest in the wilderness. Always observe wildlife from a distance and never disturb or feed the animals. Feeding the wildlife damages their health and alters natural behaviors exposing them to predators and other dangers.

For more information visit <http://www.lnt.org> or <http://www.nps.gov/noca/lnt.htm>.